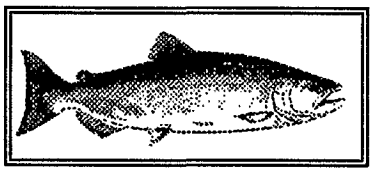
CALFED Vision for Chinook Salmon



The CALFED vision for Central Valley chinook salmon is to achieve naturally spawning population levels that support and maintain ocean commercial and recreational and inland recreational fisheries and that fully use existing and restored habitats. This is consistent with CALFED's vision of, first, restoring the endangered Sacramento River winter-run chinook salmon to levels which will allow it to be removed from the list of endangered species, secondly, increasing populations of other chinook stocks to levels that eliminate any future need for protection under the Endangered Species Act, and lastly, providing population levels for all chinook stocks that sustain recreational and commercial fisheries and other scientific, educational and non-consumptive uses of these valuable resources. In attaining this vision, CALFED seeks to maintain and restore important ecological functions and processes that create and maintain chinook salmon habitats and to reduce or eliminate stressors and known sources of mortality. During the period that chinook salmon stocks are rebuilding, CALFED will seek to maintain cohort replacement rates of much greater that 1.0 to ensure that each subsequent generation of chinook salmon is greater than its parental generation. When chinook stocks build to desired levels, CALFED will seek to maintain a long-term cohort replacement rate equal to 1.0 to ensure that future populations do not decline below desired levels. In attaining the vision for chinook salmon, CALFED also anticipates that the age structure of Central Valley naturally spawning populations will shift from predominantly age 3 and 4 fish to a structure that includes a larger component of fish of ages 4 and 5. Older female salmon are generally larger and produce more eggs, which will in turn increase the resilience of the overall population and individual stocks to unforseen stressors.

Ecological Health of Naturally Spawning Chinook Salmon Populations

Winter-run chinook	*F*
Spring-run chinook	*D*
Late-fall-run chinook	*C*
San Joaquin fall-run chinook	*D*
Sacramento fall-run chinook	*B*

Background

Chinook salmon represent a highly valued biological resource and a significant biological legacy in the Central Valley of California. Central Valley chinook salmon are composed of numerous individual stocks including the Sacramento fall-run, late-fall-run, spring-run, winter-run, and San Joaquin fall-run. The continued existence of Central Valley chinook salmon is closely linked to overall ecosystem integrity and health. Due to their life history requirements, typical of all Pacific salmon, Central Valley chinook salmon require high quality habitats for migration, holding, spawning, egg incubation, emergence, rearing, and emigration to the ocean. These diverse habitats are still present throughout the Central Valley and are successfully maintained to varying degrees by existing ecological processes. Even though the quality and accessibility of the habitats have been diminished by human-caused actions, these habitats can be restored through a comprehensive program that strives to restore or reactivate ecological processes, functions, and habitat elements on a systematic basis, while reducing or eliminating known sources of mortality and other stressors that impair survival.

Identification and Status of Key Habitats, Ecosystem Processes, and Stressors

Chinook salmon are found in virtually all Ecological Zones and many of their respective ecological units. Overall, the decline of the chinook population resulted from the cumulative effects of degradation of spawning, rearing and migration habitats in the Sacramento and San Joaquin basins and the Sacramento-San Joaquin Delta. Specifically, the decline was most likely precipitated by a combination of factors that reduced or eliminated important ecological processes and functions such as: 1) excessively warm water temperatures during the pre-spawning, incubation and early rearing period of juvenile chinook 2) the interruption or blockage of the free passage of juveniles and adults at diversion and storage dams, 3) loss of natural emigration cues due to altered flow regimes resulting from the export of water from large diversions in the South Delta, 4) heavy metal contamination from sources such as Iron Mountain Mine, 5) entrainment to a large number of unscreened and poorly screened diversions, and 6) degradation and loss of woody debris, shaded riverine aquatic, riparian corridors and forests, and floodplain functions and habitats due to such factors such as channelization, levee construction, and land use.

Climatic events and water management decisions exacerbated these habitat problems through extended droughts leading to low flows and higher temperatures, and periodic El Niño conditions in the Pacific Ocean, which reduced salmon survival by altering ocean current patterns and productivity.

A host of other factors has also contributed to the decline of the chinook but perhaps to a lesser degree. These include the various smaller water manipulation facilities and dams; extensive loss of rearing habitats in the lower Sacramento River, San Joaquin River and Sacramento-San Joaquin Delta through levee construction and marshland reclamation; and the interaction and predation by introduced species. Ocean and inland recreational and commercial salmon fisheries have likely impaired stock rebuilding efforts.

Efforts under existing fisheries regulatory measures have failed to protect some chinook stocks as healthy populations, and as a result, the winter-run population was afforded protection under the Endangered Species Act (ESA) as a last resort to avert their extinction. Since its listing, some significant habitat problems in their critical habitat have been ameliorated to help preserve this and other chinook populations. These include improved water temperatures and flow management for spawning, incubation, and rearing; improved passage of juveniles and adults at diversions dams on the upper Sacramento River; tempering of water export in the Delta during late winter and early spring, and the installation of positive barrier fish screens on the larger water diversions along the Sacramento River. However, additional measures and extensive habitat restoration which focus on reactivating or improving ecological processes and functions which create and maintain habitat will be necessary to fully recover the various chinook salmon stocks present in the Central Valley

Ecosystem Restoration Needs and Opportunities

Rebuilding chinook populations to a healthy state will require a coordinated approach to restoring ecosystem processes and functions, restoring habitat, reducing or eliminating stressors, and wise

management and operation of the six salmon hatcheries in the Central Valley.

Harvest management will play an important role in restoring healthy salmon populations, and CALFED anticipates a highly synergistic relationship between the restoration of ecological processes and functions that create and maintain habitat, and harvest management recommendations that are attuned to the productivity of the naturally spawning stocks during the period that salmon stocks are rebuilding to desired levels.

Ecosystem Processes

Within the broad context of ecosystem restoration, salmon restoration will include a wide variety of efforts, many of which are being implemented for other ecological purposes or which are nonspecific to chinook salmon. For example, restoration of riparian woodlands along the Sacramento River between Keswick Dam and Verona will focus on natural stream meander, flow, and natural revegetational/successional processes. These will be extremely important in providing shaded riverine aquatic habitat, woody debris, and other necessary habitats required by lower trophic organisms and juvenile and adult salmon populations.

Another example is to reactivate tidally influenced fresh and brackish marshes. These actions will greatly increase the production of lower trophic organisms and improve the food web, and will substantially increase the complexity of near shore habitats in the lower main stem rivers, Delta, and Bay which will be valuable habitats for juvenile salmon.

Operation of the water storage and conveyance systems throughout the Central Valley for their potential ecological benefits can be one of the more important elements in restoring a wide spectrum of ecological resources including chinook salmon.

Stressors

Ocean commercial and ocean and inland recreational fisheries annually remove a significant component of the adult fish from the potential spawning population. Harvest in conjunction with the condition of inland migration, holding, spawning, and nursery areas have contributed to the present depleted status of most stocks. This is discussed in greater detail in the CALFED Vision for Harvest.

Inadequate connectivity between upstream holding, spawning, and rearing habitat in certain tributary streams has impaired or reduced the reproductive potential of some stocks such as spring-run chinook salmon. These issues are discussed in greater detail in the CALFED visions for the 14 ecological zones.

Unscreened diversions are ubiquitous throughout the Central Valley. They are a known source of mortality and are discussed in greater detail in the CALFED Vision for Water Diversion.

Pathway to Vision

Many action-oriented activities are underway in the Central Valley which will assist CALFED in achieving its vision for chinook salmon. Some are site-specific restoration actions while some are longer term evaluations designed to develop prescriptive measures to eliminate stressors and improve ecological processes and habitats. Examples follow:

Ongoing activities:

- Close Delta Cross Channel from November through January.
- Reduce Delta exports during December through February.
- Maintain base flow in the Sacramento River and Delta in dry years and a winter base flow consistent with 1960s and 1970s.
- Compete construction and operate the Shasta Temperature Control Device.
- Supplement gravel in stream exhibiting deficiencies.
- Provide late winter/early spring pulse flow in dry and normal years.
- Control predatory fish populations in specific areas where predation is a problem such as striped bass in Clifton Court Forebay and Sacramento squawfish at Red Bluff Diversion Dam.
- Reduce the sport and commercial harvest of naturally produced salmon.
- Reduce frequency and adverse effects of stranding young fish in bypasses and floodplains.
- Use hatcheries to support certain depleted stocks.
- Operate a seasonal barrier at the head of Old River.
- Implement export ramping during May 15 to May 31.
- Upgrade fish protection facilities at the State and Federal pumping facilities in the Delta.
- Improve hatchery practices by incorporating genetic selection, revising release locations, and revising timing of release.

Potential activities under evaluation and development:

- Improve and increase shaded riverine aquatic habitat along main stem rivers and in the Delta.
- Improve and increase riparian habitat along main stem rivers and in the Delta.
- Reduce toxic loadings in rivers and streams and in the Delta.
- Eliminate or reduce the adverse environmental effects resulting from the operation of the Red Bluff Diversion Dam.
- Eliminate or reduce the adverse environmental effects resulting from the operation of the Anderson-Cottonwood Irrigation District dam on the main stem Sacramento River.
- Protect, improve and restore the stream meander belts along the Sacramento and San Joaquin rivers.
- Screen all diversions or eliminate their adverse effects.
- Improve base flows in rivers and streams.
- Improve temperatures below major impoundments.
- Improve Delta outflow during the winter and spring.
- Reduce exports to a maximum of 35% in November through January.
- Eliminate Clifton Court Forebay.
- Relocate the intake structures of the State and Federal Delta pumping plants to the main stem Sacramento River and install appropriately designed fish screens.

Linkage to Other Restoration Programs

Three major programs to restore chinook salmon populations exist within the Central Valley. The U.S. Fish and Wildlife Service is required by the Central Valley Project Improvement Act (Public Law 102-575) to double the natural production of Central Valley anadromous fish stocks by the year 2002.

The National Marine Fisheries Service is required under the Endangered Species Act to develop and implement a recovery plan for the endangered winter-run chinook salmon and to restore the stock to levels which will allow its removal from the list of endangered species. The California Department of Fish and Game is required under State legislation (The Salmon, Steelhead Trout and Anadromous Fisheries Program Act of 1988) to double the numbers of salmon that were present in the Central Valley in 1988.

Additionally, CALFED needs to consider and cooperate in other programs in the Central Valley which seek to improve conditions for chinook salmon. Included in these are actions sponsored under terms of the Agreement between U.S. Bureau of Reclamation and the California Department of Fish and Game to Reduce and Offset Direct Fish Losses Associated with the Operation of the Tracy Pumping Plant and the Tracy Fish Collection Facility (Tracy Pumping Plant Agreement), the Agreement between the Department of Water Resources and the Department of Fish and Game to Offset Direct Fish Losses in Relation to the Harvey O. Banks Delta Pumping Plant (Four Pumps Agreement), and projects funded through Proposition 70, Augmented Salmon Stamp Account, Striped Bass Stamp Account, and other smaller sources of restoration funds.

Each of the major chinook salmon restoration/recovery programs has developed specific recovery/restoration goals for Central Valley chinook salmon stocks (Table 1). Although CALFED embraces each of the restoration goals, CALFED will contribute to each agency's program through the restoration of critical ecological processes and functions, habitats, and reduction or elimination of stressors. CALFED's approach is to contribute to the management and restoration of each stock with the purpose of maintaining cohort replacement rates of much greater than 1.0 while the individual stocks are rebuilding to desired levels. When the stocks approach the desired population goals, CALFED will contribute to maintaining cohort replacement rates a 1.0.

TABLE 1. Recovery and Restoration Goals for Central Valley Chinook Salmon.

Stock	Population Goals for Recovery, Restoration, and Management of Central Valley Chinook Salmon			
	USFWS [1, 2]	NMFS [3, 4]	CDFG [5, 6]	PFMC [7, 8]
Sacramento winter-run chinook salmon	111,000	20,000	4,200	no goal
Sacramento fall-run chinook salmon	568,800	no goal	450,000	122,000 to 180,000
Spring-run chinook salmon	68,000	no goal	23,300	no goal
Late-fall-run chinook salmon	68,000	no goal	21,400	no goal
San Joaquin fall-run chinook salmon	181,200	no goal	44,000	no goal

Addendum: Notes on developing criteria regarding the ecological health of Central Valley chinook salmon stocks.

1 U.S. Fish and Wildlife Service, Anadromous Fish Restoration Program, 1995.

2 Production goal includes ocean and inland harvest and escapement.

3 National Marine Fisheries Service, Recommendations for the Recovery of the Sacramento Winter-run Chinook Salmon, 1996.

4 Goal is for escapement of spawning fish to the river and does not address harvestable surplus.

5 California Department of Fish and Game, Salmon, Steelhead Trout and Anadromous Fisheries Program Act, 1988.

6 Goal is for escapement of spawning fish to their natal rivers and streams.

7 Pacific Fishery Management Council sets goals consistent with national standards prescribed in the Magnuson Fishery Management and Conservation Act and regional framework management plan.

8 Minimum escapement goal set at 122,000 spawners, 180,000 spawners designated as management goal when habitat is improved.

The Ecological Health of Central Valley chinook salmon stocks is based on a calculated comparison of the recent 5-year average returns of the naturally spawning stocks compared to the 10-year average of 1967-1976. These data are as follow:

TABLE 2. Historic 10-year (1967-1976) total chinook salmon spawning population compared to recent 5-year average returns for naturally spawning Central Valley chinook salmon populations.

Chinook Salmon Stock	Historic 10-year average return (1967-1976)	Recent 5-year average return	5-year period of record	Percent of recent to historic
Winter-run	49,466	802	1992-1996	1.6
Spring-run	16,008 [9]	3,175	1992-1996	19.8
Late-fall-run	23,478	7,945	1989-1993 [10]	33.8
Sacramento fall-run	185,076	137,252	1991-1995	71.5
San Joaquin fall-run	20,697	3,110	1991-1995	15.0

9 Historic 10-year period included estimates for main stem Sacramento River spring-run chinook salmon.

10 Late-fall-run chinook were last enumerated at the Red Bluff Diversion Dam in 1993. Since 1993, the dam has been removed during the upstream migration period of late-fall-run chinook and no population estimated have been developed.